

AEROASSIST FLIGHT EXPERIMENT (AFE)

AIAA / OAST CONFERENCE
ON CSTI AND PATHFINDER

TECHNOLOGY FOR FUTURE
NASA MISSIONS

SEPTEMBER 12-13, 1988

P. M. Siemers / NASA LaRC

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AEROASSIST FLIGHT EXPERIMENT (AFE)



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AEROASSIST FLIGHT EXPERIMENT

OBJECTIVE:

**TO INVESTIGATE CRITICAL VEHICLE DESIGN AND
ENVIRONMENTAL TECHNOLOGIES APPLICABLE TO
THE DESIGN OF AEROASSISTED SPACE TRANSFER
VEHICLES**

AEROASSIST FLIGHT EXPERIMENT (AFE)

Mission Profile - Simulates OTV Aeropass



Deploy from
Shuttle



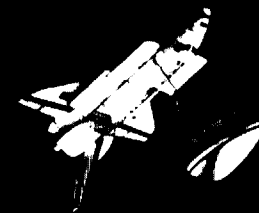
Accelerate to
Atmospheric Entry



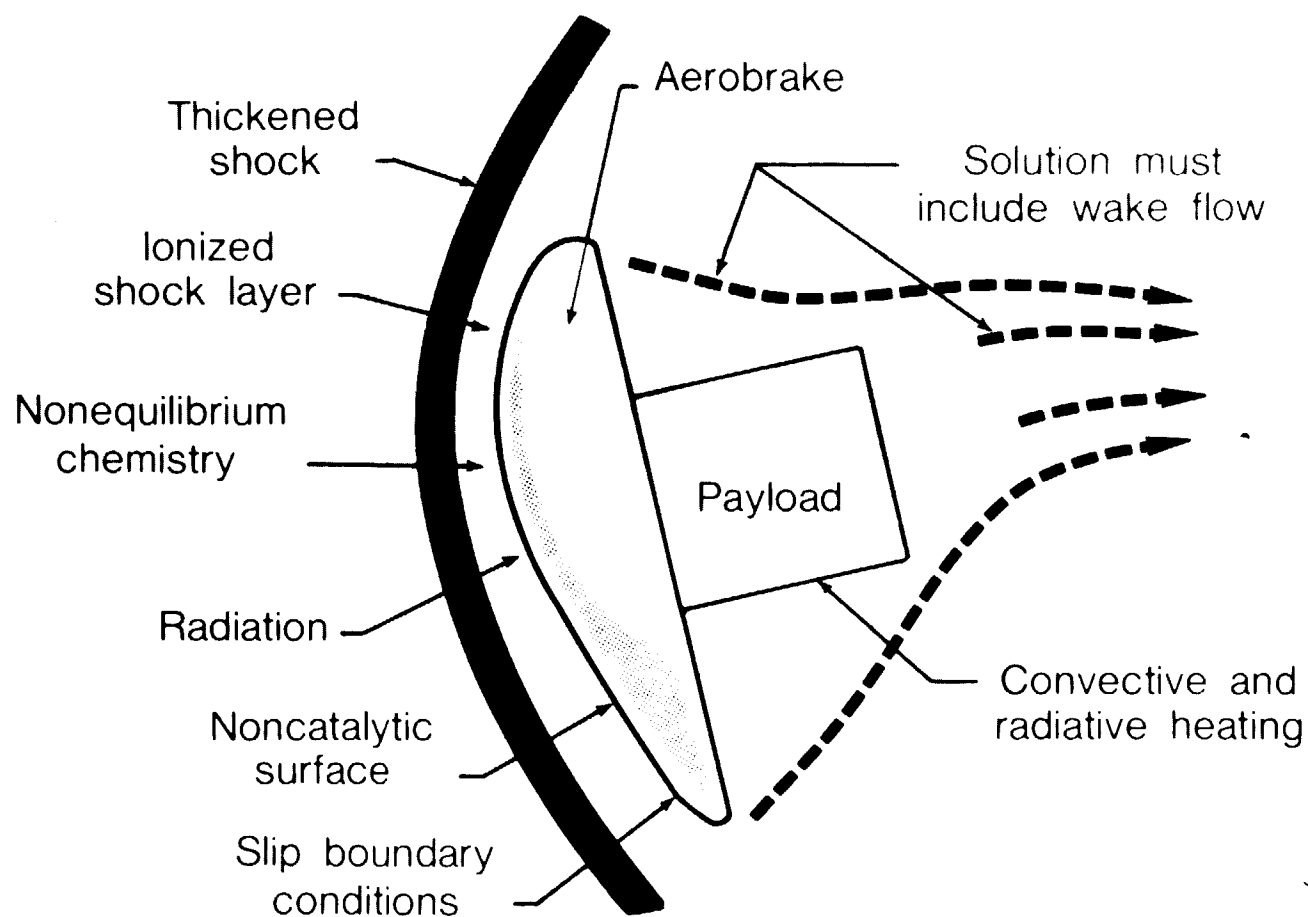
Simulate Geosynchronous
Return Aeropass



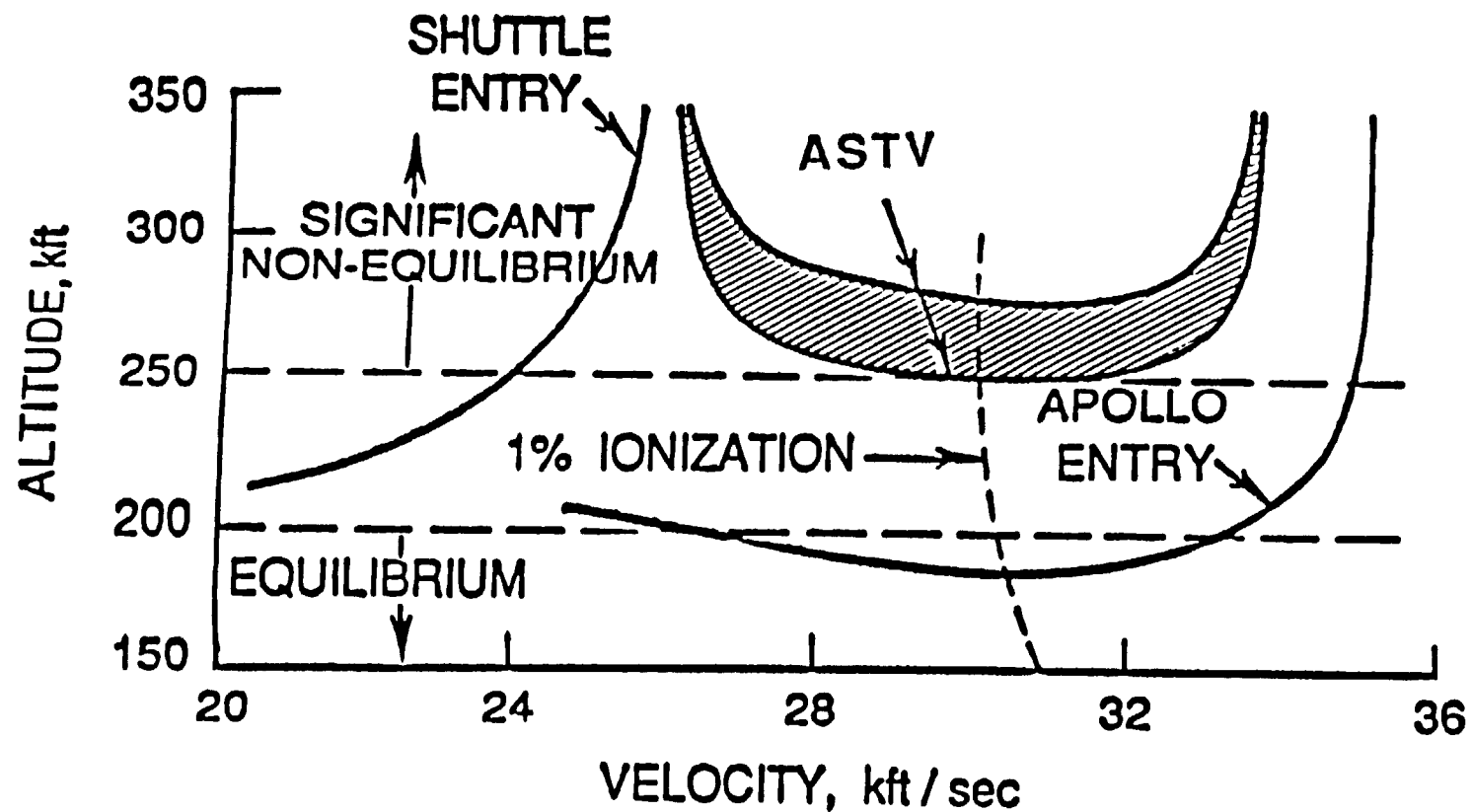
Return to Earth Orbit
for Shuttle Pick-up



AOTV DESIGN / AFE SIMULATION CHALLENGES



ASTV FLIGHT REGIME



ASTV REQUIREMENTS SUMMARY

- INABILITY TO ESTABLISH DATA BASE REQUIRED IN GROUND FACILITIES ESTABLISHES NEED FOR COMPUTATIONAL CAPABILITIES WHICH MUST BE VERIFIED USING FLIGHT DATA
- EXISTING FLIGHT DATA NOT APPROPRIATE FOR ASTV
- AEROASSISTED TECHNOLOGY FLIGHT EXPERIMENT REQUIRED

AFE MISSION OBJECTIVES

OBTAIN DATA TO:

- **RESOLVE RADIATIVE HEATING ISSUE**
- **DETERMINE WALL CATALYSIS EFFECTS**
- **DEVELOP / DEMONSTRATE TPS MATERIALS**
- **DEFINE WAKE FLOW, BASE HEATING**
- **ASSESS AERODYNAMICS AND CONTROL**
- **PROVIDE CFD CODE VERIFICATION DATA**

AFE DESIGN / MISSION REQUIREMENTS

CONFIGURATION:

- SHOCK LAYER THICKNESS \geq 7 INCHES
- BLUNT, RIGID FOREBODY
 - DIAMETER \geq 12 FEET
- L/D 0.2 — 0.3
- ROLL CONTROLLED
- NON-ABLATIVE HEATSHIELD
- RECOVERABLE

TRAJECTORY:

- ENTRY INTERFACE (400,000 FT) \geq 33,800 FPS
- RELATIVE VELOCITY \geq 31,660 FPS AT 279,000 FEET ALTITUDE
- PERIGEE = 250,000 \pm 13,000 FEET
- QUIESCENT PERIOD PRIOR TO PERIGEE (30 SEC)

AFE INSTRUMENTATION

ASTV TECHNOLOGY ISSUE

AFE EXPERIMENT

SHOCK LAYER RADIATION
SURFACE CATALYSIS
TPS MATERIALS

- RADIATIVE HEATING (RHE)
- WALL CATALYSIS (WCE)
- HEAT SHIELD PERFORMANCE (HSP)
- ALTERNATE THERMAL PROTECTION MATERIALS (ATPM)

WAKE FLOWS / HEATING

- BASE FLOW AND HEATING (BFHE)
- AFTERBODY RADIOMETRY (ARE)
- AFT FLOW IONIZATION (AFIE)

AERODYNAMICS / CONTROL

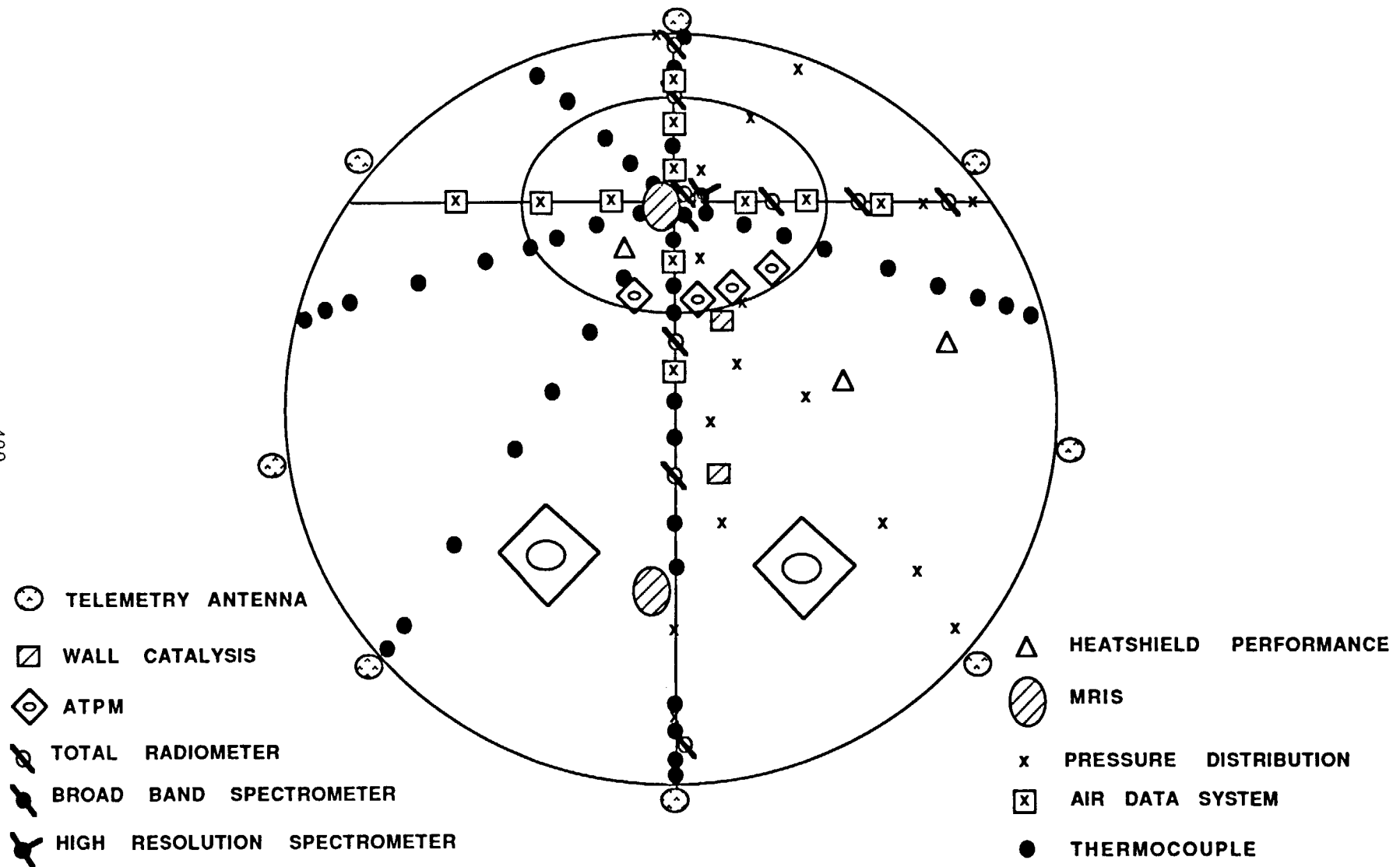
- AERODYNAMIC PERFORMANCE (APEX)
- RAREFIED-FLOW AERODYNAMIC MEASUREMENT (RAME)
- AIR DATA SYSTEM (PD/ADS)

COMPUTATIONAL FLUID
DYNAMICS

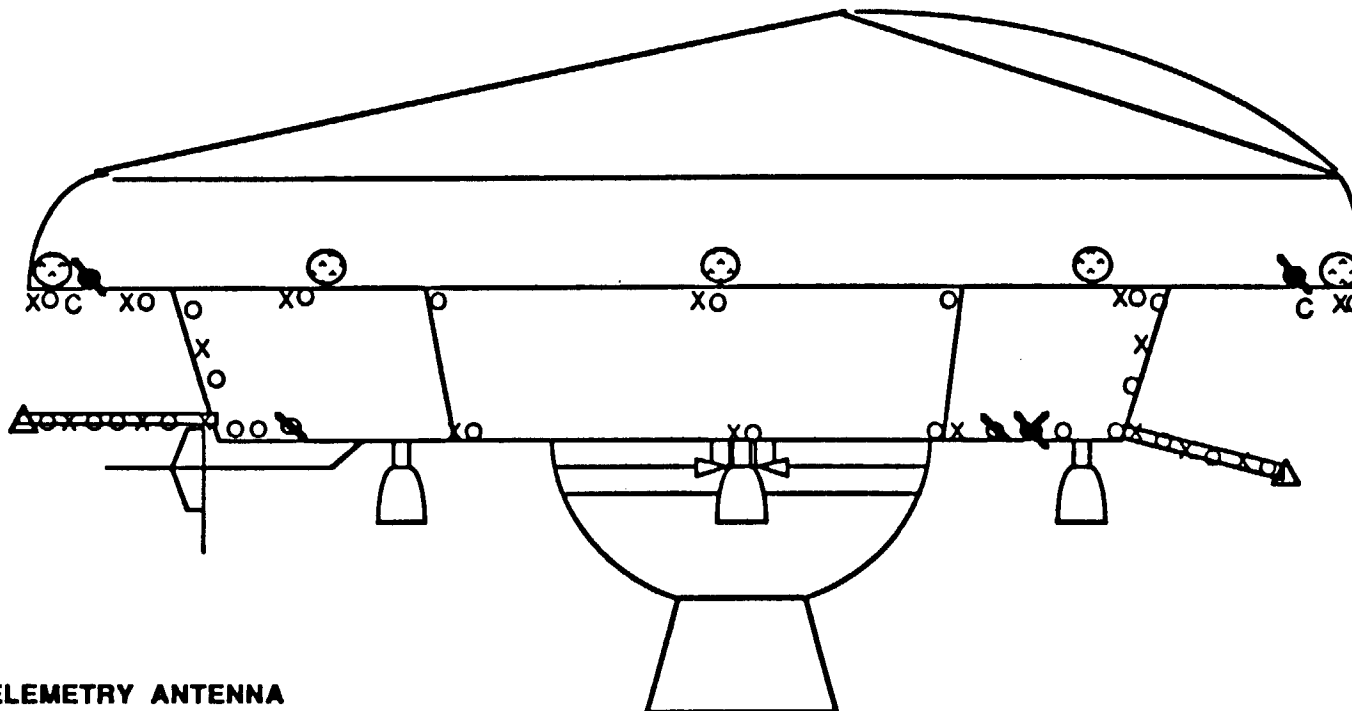
- PRESSURE DISTRIBUTION (PD/ADS)
- FOREBODY AEROTHERMAL CHARACTERIZATION (FACE)
- MICROWAVE REFLECTOMETER IONIZATION SENSOR (MRIS)
- RAREFIED-FLOW AERODYNAMIC MEASUREMENT (RAME)

FOREBODY INSTRUMENTATION

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BASE REGION INSTRUMENTATION



- ⊗ - TELEMETRY ANTENNA
- X - PRESSURE TAP
- O - THERMOCOUPLE
- △ - LANGMUIR PROBE
- C - CAMERA VIEWPOINT
- ⊗ - TOTAL RADIOMETER
- ⊗ - BROAD BAND SPECTROMETER
- ⊗ - HIGH RESOLUTION SPECTROMETER

AEROASSIST FLIGHT EXPERIMENT (AFE) PROJECT SCHEDULE

